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BUREAU OF ENTOMOLOGY
and Plant Quarantine
FOREST INSECT INVESTIGATIONS

CONTROL OF THE FIR BARK LOUSE

by S. F. Potts

and

DETAILED OBSERVATIONS ON THE FIR BARK LOUSE SPRAYING PROJECT

by H. J. MacAloney

Northeastern Forest Insect Station
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Control of the Fir Bark Louse

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Purpose: To develop an insecticidal method for controlling the fir bark louse that will not injure the tree. The primary purpose of this investigation was to free several groups of trees of this insect in order to study the nature of injury and ability of the trees to recover from an attack. Information on the control of the insect on roadside and shade trees was also desired.

Dr. MacAloney is studying the injury problem. He also made the observations on the sprayed plots given near the end of this report. The writer was concerned merely with treatment and control.

Fir Bark Louse

Place: Grantham, N. H.

Five plots laid out as follows, and 4 treated:

1. Check (No treatment) — $\frac{1}{8}$ acre
2. Lime sulphur conc. 1:9 — " "
3. Lime sulphur conc. 1:20 — " "
4. Sunoco oil 4% — " "
5. Volck oil 4% — " "

Diagram of Plots

Check
L.S. 1:9
L.S. 1:20
Sunoco 1:25
Volck 1:25

The above plots were treated with a power sprayer using a solid stream through a 1/8 inch nozzle tip.

Plot 2. Started at 10:30 A.M. Finished at 11:00 A. M. Humidity estimated to be 90 to 97%. Cloudy. A very light shower fell after treatment before all of the spray had dried. Date April 24. Used 300 gallons.

Plot 3. April 24. Started at 11:10. Finished three-quarters of plot at 11:30 when rain set in. A light shower fell washing off some spray from the tree tops, possibly not serious. Finished the other quarter of the plot at 7:20 A.M. April 25. Clear and cool on April 25. Very cold over night with heavy frost and some ice in the spray hose. Used 300 gallons.

Plot 4. There has been practically no wind until 8:00 A.M. in any of the plots. After 8:00 the wind velocity began to increase rapidly. Started plot 4 at 8:10 A.M. Ended about 8:45 A.M. Used 300 gallons. Wind rising, temperature rising slowly, clear, humidity falling.

There was much waste of solution in all plots. This was difficult to avoid for all or practically all of the infestation is on the trunk. A combination mist and solid stream nozzle should be developed to prevent this waste. It is difficult to cover all tall trees thoroughly on all sides where foliage, bole, and limbs must be sprayed with a solid stream. This is aside from the more fundamental needs for radically different spray or dust machinery referred to elsewhere.

Plot 5. Completed about 10:45 A.M. April 25. Used 150 gallons. There was a wet swampy area near the road of about 1/10 acre each in plots 4 and 5. Plot 5 not quite as dense as the other plots. There was also an open place of about 1/8 acre in plot 5.

General Notes

After $\frac{3}{4}$ of plot 3 (L.S. 1:20) had been sprayed a rain of about .03 inch fell but did not seem to wash off much of the insecticide. The effect of the frost should be watched.

The density, height, and vitality of the trees varies as also does the infestation. Many of the trees were heavily infested and a good portion of the oldest ones were dead. The younger trees and seedlings were very green and mostly well foliated; however, in many cases, they had swellings or galls and therefore some deformation due to the effect of the summer form of the fir bark louse.

The height of the trees was from 15 to 60 feet, and the density was medium. A small proportion of spruce and hemlock was present.

It took 15 minutes to empty the tank with 1/8 inch tip. A small amount of ice and snow was on the ground in a few places in the plots.

The infestation was heaviest in plot 3 (L.S. 1:20), with a great many large dead trees. The infestation was probably lightest in plot 1 and plot 5. Much balsam had been cut out of most of the plots resulting in considerable young growth and stumps, particularly in plot 1.

Meteorological records from the nearest weather bureau stations for April 24, 25, and 26 should be obtained giving humidity, temperature, wind, sky condition, rainfall. These have not as yet been obtained. Dr. MacAloney states there is no weather bureau station near.

Records: Dr. MacAloney took records, beginning about the middle of May on percent kill, rate of reinfestation, migration, degree of injury to the trees, rate of recovery of trees of different ages and different degrees of infestation, growth, etc., and other data in which he was interested. This is to be compared with similar data from the check area.

I believe that it would be better to make the treatment in the fall and that it might be advisable to use other insecticides.

In the case of the hand sprayed plots one must watch out for reinfestation of the sprayed portions by insects from the upper part of the tree.

	Hand sprayed plots.	April 25
	Started at 9:35 A.M.	Finished at 10:55 A.M.
Tag #901	Derris 1-500	Large tree--medium heavy attack
" 902	Derris 1-500	Small tree--no noticeable infestation
	Used solid stream. All others treated with mist.	
" 903	Nicotine sulphate 1-400 + 10 c c soap to 4 liters - large tree - heavy attack.	
" 904	Same - Except small tree - No attack.	

Tag #905 Nicotine sulphate 1-800 + 10 c c soap per 4 liters - large tree - heavy attack.

" 906 Same - small tree - no attack.

" 907 Pyrethrum 1-400 - large tree - heavy attack.

" 909 Same - small tree - no attack.

" 910 Derris 1-500 + 1% soluble pine oil - large tree - light attack.

" 911 Same - small tree - no attack.

" 912 Sunoco 2% - large tree - very light attack.

" 913 Same - small tree - no attack.

" 914 Sunoco 1% - large tree - very light attack.

" 915 Same - small tree - no attack.

" 916 Calcium Cyanide dust - 40% Ca (cn_2) - large tree - medium heavy attack.

" 917 Same - 5 little trees - no attack.

Wind rising - now strong. This one plot is just outside of plot 1 near the road.

Most of these small non-infested trees were <u>beneath</u> tall heavily infested trees.

I think if Dr. MacAloney selects his trees for observation and measurement from the center area of each plot, allowing a border of 15 to 25 feet on each side, he will be perfectly safe in escaping drift. Each tree can then be tagged.

No further work is planned.

The 1934 infestation of these trees by plots follows:

Plot		Heavy	Medium	Light	No Attack
Check	1	4	2	1	5
L-S (1-9)	2	1	11	-	-
L-S (1-20)	3	4	2	6	-
Sunoco	4	2	2	7	1
Volck	5	-	-	4	8

On June 10-12 a detailed examination was made to determine the amount of new infestation and also the general condition of the trees in each plot.

Plot 1- Check. There are several dead trees at the upper end of the plot. There is heavy gout on the reproduction under these trees and also under the heavily attacked living trees. There is no 1935 gout yet. New wool is noticeable on the trees already infested, but it is not as heavy as the 1934 attack. The 1935 leaf development is vigorous. One heavily infested tree has an open wound at the base, probably caused by carpenter ants, and one dead root. Another tree heavily attacked last year is in poor condition and there has been little growth this spring. A suppressed tree has a heavy stem attack but no apparent gout, and has abnormal taper in the upper bole.

Plot 2- Lime Sulphur (Concentration 1-9) There are several dead trees at the upper end of the plot and heavy gout is present on practically all the old growth of the reproduction. No new gout is apparent this year and the 1935 growth is well developed. There is no sign of new stem attack and the old wool is still persisting, with many dead lice on the bark.

There would appear to be complete control in this plot. There is no damage to the foliage; the lime sulphur discoloration is still evident on all of the trees, particularly on the boles.

Plot 3- Lime Sulphur (Concentration 1-20) There are some large dead trees scattered throughout the plot, and there is heavy gout on the reproduction. No new attack is apparent this year and the 1935 growth is vigorous. The lime sulphur discoloration is still noticeable, and there is no damage to the foliage. Control apparently is complete.

Plot 4- Sunoco Oil (Concentration 1-25) There are no dead trees in this plot. There was a small amount of gout in 1934 but there is none in 1935. The 1935 growth is vigorous. Two of the lightly attacked trees show signs of possible light 1935 attack, which indicates that there may not be complete control in this plot. This is borne out also on tree #912 sprayed with Sunoco 1-50, although this new attack may have been caused by migration from above. There is no apparent injury to the foliage and the oil discoloration is still evident.

Plot 5- Volck Oil, Concentration 1-25. This plot is the most northerly and the infestation is scattered and light. There, also, is not so much fir and there is an open space of about 1/8 acre. There is no sign of new attack on the four trees lightly attacked in 1934, but one tree heavily attacked in 1934 has a light attack this year. This tree may not have been thoroughly sprayed and therefore should not be used. The oil discoloration is evident on some trees but has disappeared on others. There is no apparent damage to the foliage.

It appears that there is good control on all plots; even in the Sunoco plot the new attack is very light. The attack on the trees in the Check plot is definitely more than in 1934. There is no sign of 1935 gout in any of the plots.

Examination of the individual trees, sprayed with various insecticides shows the following results:

901--Derris 1-500. Many young larvae all over lower part of bole and scattered new spots of wool. Not all of these could have migrated from above the sprayed area. Heavy attack in 1934.

902--small tree same spray as 901. Foliage OK, no sign of new attack.

903--Nicotine sulphate 1-400 plus 1000 cc soap to 4 liters. Heavy 1934 attack-this tree died this spring-no observations made.

904--small tree same spray as 903. Foliage OK, no sign of new attack.

905--Nicotine sulphate 1-800 plus 1000 cc soap to 4 liters. Scattered spots of new wool this year and a few young larvae at base of tree. Heavy attack in 1934.

906--small tree, same spray as 905. Foliage OK, no sign of new attack.

907--Pyrethrum 1-400. Large tree-heavy 1934 attack. Numerous new spots of wool at base-eggs and young larvae present. It is not probable that all these dropped down from above the sprayed area.

909--small tree, same spray as 907. Foliage OK, no sign of 1935 attack.

910--Derris 1-400 plus 1% soluble pine oil. Large tree with light attack in 1934. No 1935 attack apparent.

911--small tree, same spray as 910. Foliage OK, no sign of 1935 attack.

912--Sunoco 2%. Large tree with very light 1934 attack. New wool and scattered young larvae at base of tree. The attack is still very light.
913--small tree, same spray as 912. Foliage OK, no sign of 1935 attack.

914--small tree, same spray as 915. Foliage OK, no sign of 1935 attack.
915--Sunoco 1%. Large tree with very light attack. No new wool or young larvae could be found.

916--Calcium Cyanide dust--40% Ca (cn_2) Large tree-medium attack. Young larvae and some new wool present.
917--same as 916. Several small trees. Foliage OK, no sign of new attack.

All these plots were examined again on August 27, 1935.

Plot 1- (Check) At that time 7 of the 12 trees were apparently free of attack, whereas in 1934 five trees were not attacked. In addition, two trees, one with heavy and one with medium attack in 1934, apparently were almost entirely freed from attack because the insects were frozen to death. One tree shows a heavy attack in 1935 and two others have a medium attack in 1935. There was a heavy gout in 1934 but there is none in 1935.

Plot 2- (L-S 1-9) There is no sign of 1935 attack; tree #4 is, however, in poor condition. The lime sulphur discoloration is still noticeable and a very faint sulphur odor is also apparent.

Plot 3- (L-S 1-20) There is no sign of 1935 attack. The lime sulphur discoloration and odor is still slightly apparent.

Plot 4- (Sunoco 1-25) There apparently is a very light 1935 attack at the base of tree #12. Control, however, should be considered as good.

Plot 5- (Volck 1-25) No 1935 attack is apparent. The big tree on the north line, which apparently was not sprayed, has a very heavy 1935 attack.

In the case of the individual trees the following observations were made:

Tree #901 - (Derris 1-500) Light to medium 1935 attack.

Tree #907 - (Pyrethrum 1-400) Very light 1935 attack.

Tree #910 - (Derris 1-400 etc.) Very light 1935 attack.

Tree #912 - (Sunoco 1-50) Light to medium 1935 attack.

Tree #915 - (Sunoco 1-100) Very light 1935 attack.

Tree #903 - (Nicotine Sulphate 1-400 etc.) Tree died in 1935.

Tree #905 - (Nicotine Sulphate 1-800 etc.) Apparently no 1935 attack now.

Tree #906 - (Calcium Cyanide dust) Light-medium 1935 attack.

Summary

In the half acre plots sprayed with Lime-Sulphur 1-9, Lime-Sulphur 1-20, and Volck 1-25 there is complete control. The very light infestation on one tree in the Sunoco plot should not cause this insecticide to be thrown out, as control was nearly complete. Complete control may depend almost entirely on coverage. There is some re-infestation on the sprayed individual trees, but this may have been caused by migration or dropping from above the sprayed portion.

There does not seem to be any injury to the foliage. The discoloration by all three materials used on the larger plots was still evident late in August, and a very slight sulphur odor was apparent close to the boles of the treated trees.

These plots should be examined in the spring and early fall of 1936 for detailed observation, on recovery of the trees and presence of new infestation.

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Detailed Observations on the Fir Bark Louse Spraying Project.

BY

H. J. MacAloney

Five half-acre plots were established April 24, 1935 on land owned by H. R. Sherman, Grantham, N. H. The location of these plots is on the right of Route 10 about one-half mile north of the owner's home. The area of infested fir covers several acres. The location chosen has had a heavy infestation for some years, a number of large trees have died and there has been a considerable amount of gout on both large trees and small seedlings. In addition a small stream runs through the center of the plot area.

The boundaries of the plots were marked with white paint; corner trees were marked with double bands and perpendicular lines. A large tree at the center of each plot on the line running along the road was marked with the number of the plot, running north from the check Plot which was on the south end of the series.

On May 25 twelve trees in each plot were selected for detailed study. These were numbered from 1 to 12 in each plot at a height of about 4 feet.

The crown classes of these trees by plots follows:

	Plot	Dominant	Codominant	Intermediate	Suppressed
Check	1	4	5	2	1
L. S.	2	8	4	-	-
L. S.	3	3	4	3	2
Sunoco	4	5	7	-	-
Volck	5	4	6	2	-